REMARKS

Claims 1-23 were pending in this application.

Claims 1-23 have been rejected.

Claim 15 has been amended as shown above.

Claims 1-23 remain pending in this application.

Reconsideration and full allowance of Claims 1-23 are respectfully requested.

I. REJECTION UNDER 35 U.S.C. § 102

The Office Action rejects Claims 1-23 under 35 U.S.C. § 102(a) as being anticipated by Gao et al., "Wavelet-Based Pressure Analysis for Hydraulic Pump Health Diagnosis" ("*Gao*"). This rejection is respectfully traversed.

A prior art reference anticipates the claimed invention under 35 U.S.C. § 102 only if every element of a claimed invention is identically shown in that single reference, arranged as they are in the claims. (*MPEP § 2131; In re Bond, 910 F.2d 831, 832, 15 U.S.P.Q.2d 1566, 1567 (Fed. Cir. 1990)*). Anticipation is only shown where each and every limitation of the claimed invention is found in a single prior art reference. (*MPEP § 2131; In re Donohue, 766 F.2d 531, 534, 226 U.S.P.Q. 619, 621 (Fed. Cir. 1985)*).

Claim 1 recites grouping "decomposed signals" into a "plurality of groups," where each group includes "decomposed signals at multiple resolution levels." Claim 1 also recites identifying one or more "defect indicators" for one of the "resolution levels" using "relationships between the decomposed signals in one of the groups."

None of the portions of *Gao* cited by the Office Action anticipates these elements of Claim 1.

Gao describes how wavelet decomposition can be used to locate singularities in a signal within certain frequency bands and how a pump fault results in "specific singularities within a certain band." (*Gao, Page 971, Right column, Second paragraph*). This simply indicates that pump defects can be identified using wavelet coefficients in certain frequency bands. This portion of *Gao* says nothing about using "relationships" between multiple "decomposed signals" in a "group" to identify one or more "defect indicators," where the signals in the group are "at multiple resolution levels."

The next portion of *Gao* describes how to decompose a signal. (*Gao, Page 971, Right column, Third and fourth paragraphs; Page 972, Equation (9)*). This simply represents one technique for decomposing a signal. This portion of *Gao* says absolutely nothing about using "relationships" between multiple "decomposed signals" in a "group" to identify one or more "defect indicators."

The following portion of *Gao* describes how a signal can be decomposed into two sets of sub-band signals (a low-pass set and a high-pass set) and how the sub-band signals are "then reassembled to perform wavelet analysis." (*Gao, Page 972, Left column, First paragraph*). This portion of *Gao* states that multiple groups of sub-band signals are formed, but it also explicitly states that the sub-band signals are reassembled for wavelet analysis. This portion of *Gao* lacks any mention of using "relationships" between sub-band signals in a single "group" (a single set) to identify one or more "defect indicators."

The next portion of *Gao* lists the frequency bands for the low-frequency wavelet coefficients (a_1, a_2, *and* a_3) and the high-frequency wavelet coefficients (cd_1, cd_2, *and* cd_3). (*Gao, Page 972, Left column, Second paragraph*). Nothing here is related to using "relationships" between multiple "decomposed signals" in a "group" to identify one or more "defect indicators."

Later, *Gao* describes how a loose piston shoe can be identified using the wavelet coefficients cd_2 and how a worn swash plate can be identified using the wavelet coefficients cd_3. *Gao* also describes how, as shown in Figure 4, wavelet coefficients for a healthy pump generally stay within a normalized range or band of values. (*Gao, Page 972, Right column, Second paragraph*). This portion of *Gao* simply states that each fault is identified using the wavelet coefficients in a single high-frequency window. Loose piston shoes are identified using cd_2, and worn swash plates are identified using cd_3. This portion of *Gao* says nothing about using "relationships" between multiple "decomposed signals" in a "group" to identify one or more "defect indicators," where the signals in the group are "at multiple resolution levels." For example, *Gao* lacks any mention of grouping cd_2 and cd_3 and then using relationships between cd_2 and cd_3 to identify one or more defect indicators.

Gao then describes how a loose piston shoe can result in larger wavelet coefficients in certain frequency windows d_2 and d_3, which is shown in Figure 5. (*Gao, Page 972, Right column, Third paragraph*). While this portion of *Gao* refers to multiple frequency windows, nothing here indicates that *Gao* uses relationships between the wavelet coefficients in those windows. Rather, as clearly shown in Figure 5 of *Gao, Gao* simply determines if the wavelet

coefficients in the d_2 window fall outside of upper and lower bounds for that window. Similarly, *Gao* also determines if the wavelet coefficients in the d_3 window fall outside of upper and lower bounds for that window. *Gao* never uses relationships between the wavelet coefficients in these two windows to identify any defect indicators. As a result, this portion of *Gao* fails to anticipate using "relationships" between multiple "decomposed signals" in a "group" to identify one or more "defect indicators."

Finally, *Gao* describes how wavelet coefficients for a healthy pump generally stay within specified ranges of values, while wavelet coefficients for a defective pump stray outside of those specified ranges. (*Gao, Page 976, Left column, First paragraph*). For example, *Gao* describes how the wavelet coefficients in Figure 7 for a healthy pump have certain normal ranges of values (± 0.6 for cd_1, ± 0.4 for cd_2, and ± 0.3 for cd_3). The wavelet coefficients in Figures 8 and 9 for unhealthy pumps exceed these upper and lower bounds. This is the same functionality described above. The wavelet coefficients in a single window can be compared to upper and lower bounds for that window to determine whether a pump fault exists. Nothing here indicates that "relationships" between the wavelet coefficients in different frequency windows are used to identify one or more "defect indicators."

The Applicants believe that the Patent Office may be relying on an erroneous interpretation of *Gao* or Claim 1. *Gao* illustrates the decomposed signals for a healthy pump and for two defective pumps in Figures 4-6. Similarly, *Gao* illustrates the decomposed signals for a healthy pump and for two defective pumps in Figures 7-9. *Gao* notes how the signals in these figures can be compared to show that the wavelet coefficients for the defective pumps have a

larger variation than the wavelet coefficients for the healthy pumps in the higher frequency windows. For example, *Gao* describes how the wavelet coefficients in Figure 7 have certain ranges of values and how the wavelet coefficients in Figures 8 and 9 exceed some or all of these normal ranges.

This cannot be used to anticipate Claim 1. For example, it is inadequate for the Patent Office to show that *Gao* compares a decomposed signal from Figure 5 of *Gao* with the corresponding decomposed signal in Figure 4 of *Gao*. This is improper because the decomposed signals in Figures 4 and 5 of *Gao* are not formed by decomposing the same original signal. Rather, they are formed by decomposing different signals, one from a healthy pump (Figure 4) and one from a defective pump (Figure 5). In contrast, Claim 1 recites that "a signal" is decomposed into multiple decomposed signals at multiple resolution levels. Those decomposed signals are then grouped, and relationships between the decomposed signals in a group are used to identify at least one defect indicator at a particular resolution level. In Claim 1, the decomposed signals in the groups are related to the same original signal.

In order to anticipate Claim 1, the Patent Office must show that *Gao* (1) decomposes a signal into multiple decomposed signals, (2) groups decomposed signals at multiple resolution levels into a single group, and (3) uses relationships between the decomposed signals in that group to identify at least one defect indicator.

The Patent Office has not and cannot make this showing. To make this showing, for example, the Patent Office would have to show that *Gao* uses relationships between the cd_2 and cd_3 wavelet coefficients in Figure 5 to identify a defective pump. *Gao* does not operate in this

manner. *Gao* is crystal clear – the wavelet coefficients in a single wavelength window are compared to upper and lower bounds for that window. If the wavelet coefficients in that single window exceed the upper and lower bounds, this indicates that a pump might be defective. This cannot anticipate Claim 1, which requires that decomposed signals at multiple resolution levels be grouped and that relationships "between the decomposed signals" in that group be used to identify at least one defect indicator.

For these reasons, *Gao* fails to anticipate the Applicants' invention as recited in Claim 1 (and its dependent claims). For similar reasons, *Gao* fails to anticipate the Applicants' invention as recited in Claims 8, 15, and 21 (and their dependent claims).

Accordingly, the Applicants respectfully request withdrawal of the § 102 rejection and full allowance of Claims 1-23.

II. CONCLUSION

The Applicants respectfully assert that all pending claims in this application are in condition for allowance and respectfully request full allowance of the claims.

SUMMARY

If any issues arise, or if the Examiner has any suggestions for expediting allowance of this application, the Applicants respectfully invite the Examiner to contact the undersigned at the telephone number indicated below or at *wmunck@munckbutrus.com*.

The Commissioner is hereby authorized to charge any fees connected with this communication (including any extension of time fees) or credit any overpayment to Deposit Account No. 50-0208.

Respectfully submitted,

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